International Journal of Development and Sustainability
ISSN: 2186-8662 – www.isdsnet.com/ijds
Volume 3 Number 10 (2014): Pages 2049-2058
ISDS Article ID: IJDS13020602

Crop management decision making processes by small-scale farmers of Lower Gweru Communal area, Zimbabwe

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Abstract

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Keywords: Decision making; Local indicators; Seasonal climate forecast; Small-scale farmers

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Cite this article as: Masere, T.P. (2014), "Crop management decision making processes by small-scale farmers of Lower Gweru Communal area, Zimbabwe", *International Journal of Development and Sustainability*, Vol. 3 No. 10, pp. 2049-2058.

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1. Introduction

Decision-making is an important issue in farming enterprises of any magnitude, including small-scale, resource-constrained farming systems. The ability to make decisions involves correct analysis of the relevant information (Hansen, 2002). At various times in the year, small-scale farmers have to make climate related and crop management decisions, including crop and variety choices, planting dates, fertiliser or manure use, and weeding times and dates among others. Whatever decisions small-scale farmers make before and during the season will affect the growth and yield of crops and hence their livelihood.

Small-scale farming systems are generally located in regions with "low and erratic rainfall and a short growing season" (Vincent and Thomas, 1960 in Shumba, 1993:69). This type of farming system is characterized by low productivity and widespread persistent poverty (Rohrbach and Okwach, 1997; Selvaraju et al., 2004). Shumba (1993) noted that these systems are also characterized by small farm sizes, poor investment in farming inputs, mixed cropping and are labour-intensive. Most of these farmers even fail to produce enough food to meet their own household needs (Rohrbach and Okwach, 1997). The farmers are faced with a number of challenges that threaten their livelihoods; chief among them is climate variability and change infertile marginal soils (Altieri and Koohafkan, 2008). Climate variability effects on dryland small-scale, resource-constrained farming systems, with regards to yields of main crops, are most probably very marked (Cline, 2007).

It is thus against this background that these farmers are expected to make informed decisions. There are a number of key factors that affect small-scale farmer decision-making. Chief among them is the availability of relevant information. This information can be in the form of official seasonal climate forecasts or indigenous forecast. Small-scale farmers often have their own indicators to predict as to the nature of the season (whether it will be a good or poor rainfall season) which includes position of the moon, wind direction, plants flowering at certain times, colour of the gathering clouds and diminishing wells and springs (Ziervogel, 2001; Mapfumo, 2010). This knowledge of indicators can be described as local knowledge.

1.1. Local knowledge

Local knowledge refers to the information amassed from trying and testing solutions in addressing challenges facing people of a given culture (Prasad et al., 1996). Local knowledge is relevant to rainfed agriculture practiced by small-scale resource-poor farmers in developing countries (Prasad et al., 1996). It provides a platform for decision-making by small-scale farmers, related to both known and unknown problems affecting their farming systems and livelihoods (Hurni, 1996; Beckford and Barker, 2007). Local knowledge has been developed informally and is entrenched in local culture and traditions. This makes it accessible and understood by all members of the community regardless of the level of education of farmers.

It should be noted however, that the local indigenous knowledge has numerous drawbacks including failing to cope with climate change. Most small-scale farmers in the world still practice the same farming strategies used by their forefathers and as a result these practices are failing due to external pressures like climate change with which they are not able to cope (Roncoli et al., 2000). In other words indigenous

knowledge has not been updated and tested under the current climate variability and change and there have not been any significant improvements to the strategies used by the small-scale farmers' forefathers.

1.2. Seasonal Climate Forecasts (SCFs)

SCFs offer an indication of the nature of the season in terms of rainfall amount and average temperatures. The methods of dissemination of the SCFs include use of radio, television, newspapers or through extension staff. According to Chikoore and Unganai (2001), the most efficient method of disseminating seasonal forecast information to small-scale, resource-constrained rural communities in Southern Africa is by radio broadcast. However, findings from a study by Ziervogel (2001) in Basotho village in Lesotho, showed that most small-scale farmers preferred to get the forecast from the extension agents, citing that they do not have radios and also that the extension agents would even help them understand through demonstrations.

The aim of the SCF is to equip users (mainly farmers and extension agents) with climate information, which they can incorporate into their existing agricultural management strategies so as to make informed decisions on their farms to increase food security (Chikoore and Unganai, 2001). According to Meinke et al. (2009), application of climate forecast information by farmers is said to be effective if it leads to a change in a decision and results in either an economic improvement or reduction in risk (Carberry et al., 1996). Further, SCFs will have value only if adaptive options that can deliver genuine benefits are available (Fraisse et al., 2006). According to Phillips et al. (2001) the most valuable pieces of information from a forecast is start date of the season as well as adequacy of the rains. This information will even be more important if the forecast is issued well in advance of the season.

Small-scale farmers, however, need to have confidence in SCFs in order for them to fully embrace the information outputs of the SCFs in their decision-making. Hansen (2004) noted that farmers often demonstrate remarkable resourcefulness once they are convinced of the benefit of an innovation. Small-scale farmers often adopt conservative risk management strategies that usually result in poor utilization of the few resources they have and reduced productivity (Hansen, 2002; Hansen and Sivakumar, 2006). SCF information can be used to change this conservative way of thinking and foster better risk management through better-informed decision-making (Hammer et al., 2000; Hansen, 2002; Hansen and Sivakumar, 2006).

This study sought to achieve three objectives firstly, to determine these farmers' perceptions to climate change. Secondly, to investigate how farmers make their decisions and what guides their crop management decision making processes. Finally, the study evaluated whether these farmers can make informed decisions given relevant information which they did not have access to before. The relevant information in this case was in the form of SCFs.

2. Methodology

This research was conducted in two Wards of Lower Gweru Communal area namely; Nyama and Mdubiwa, which were selected based on their easy accessibility; their representativeness of the whole Lower Gweru

Communal area, and also because of their contrasting nature with regards to wetness/water availability. Nyama Ward is wetter than Mdubiwa as it has a higher water table than Mdubiwa which is located at a relatively higher altitude than Nyama. Lower Gweru is a developed communal settlement in the Midlands province of Zimbabwe. It is located about 40 km North West of City of Gweru, and stretches a further 50 km to the West. Lower Gweru is situated at 19° 14' 0" South and 29° 15' 0" East. Lower Gweru communal area falls in natural region (agro-ecological zone) IV of Zimbabwe which described as semi-arid to arid and receives rainfall in summer from October to April ranging from 450mm to 600mm annually, with frequent droughts. Rainfall season is characterized by periodic seasonal droughts and severe dry spells.

In order to answer the research objectives, a study was conducted amongst 30 small-scale resource-constrained farmers in the Lower Gweru Communal areas of Zimbabwe. These participants were selected by means of stratified random sampling. They were chosen because they were representative of the Lower Gweru small-scale resource constrained farming systems. Three instruments were used to collect the data required: focus group discussions (FGDs), resource allocation mapping (RAM) and semi-structured interviews (SSIs).

The focus group discussions were used to gather information about climate change using RAM and seasonal climate forecasting. Firstly farmers were asked their perceptions of climate change in their area, what guide their crop management decisions and later on were asked to map out how they allocated their resources for the 2007/8 season. The RAM session served to confirm the farmers decisions on what they actual did in their farms. Farmers were also asked the effect of climate change on their decision making.

Secondly, farmers were introduced to seasonal climate forecasts, how they work, how they differ from their indigenous indicators, their perceived benefits and limitations of SCFs. Upon finishing the lecture farmers were also tasked to make decisions for the 2008/9 season based on the SCF presented to them to guide how they would go about their crop management in their fields. Finally, the SSIs were conducted after a two year period with the same small-scale farmers. The purpose being to collect data on an individual basis and to evaluate the applicability SCFs and its information outputs in decision-making by small-scale, resource-constrained farmers.

3. Results and discussions

3.1. Farmer perceptions of climate change

All the farmers interviewed agreed that the climate was changing and identified, an increase in the number of seasons without enough rainfall; rains starting late and ending early; increased temperature extremes and reduced length of the rain season, low rainfall amount, drying up of wetlands among others as indicators/evidence of the changing climate. Farmers also pointed out that they used to have their first maize crop at flowering stage towards late December, but now it only reaches fifth leaf stage by this time. They said they also used to plant early on their wetland fields but now most wetlands have dried up. Farmers noted that the early rains that used to come in August to rot the previous crop stover in the fields are no longer

arriving. The highlighted changes were said to be affecting their maize production negatively as evidenced by poor germination leading to low yields; long dry spells resulting in increasing water stress leading to wilting; and by the reduced area under maize production as farmers are growing small grains like sorghum and millet which require less water that maize. All the farmers from Nyama Ward (which has a high water table) indicated that they will resort to gardening in the event of droughts and prolonged dry spells. Nyama Ward farmers grow vegetables, horticultural crops and to a lesser extent maize in their gardens. They get the water from shallow wells.

As noted in the first FGD, the participant farmers perceived climate to be changing; it also emerged in the SSIs that the majority of respondent farmers valued climatic information more than any other agricultural information for making decisions. This was summarized by the following quote from one of the respondent farmer:

> *"Ini ndinokoshesa nhau dzemamiriro ekunze kupfuura zvimwe zvese zvakaita sekudzidza marimiro kana zveivhu nekuti mwaka irikushanduka uye ivhu redu tinoriziva, zvakare tinoronga zvatinoda kuzoita mumwaka mushure mokunge taona kana kunzwa kuti mwaka uchange wakamira sei"* (I value climate information over other agricultural information like agronomic practices or soil management because we know our soils and they do not change like what climate is doing these days, besides it is this climatic information that determines how we will go about farming that season).

3.2. Crop management decision making by farmers

The data gathered from the SSIs, RAM and the FGDs were mostly consistent. Most of the participant farmers were advanced in age and have lived and farmed for very long periods of time (35 years and above) in their area. They have not been formally trained in agriculture. Over this long period of farming in their area, they have studied the climate of their area using local indicators and have relied on their findings to make decisions. Farmers highlighted that there are two major reasons that they are still using the same local knowledge used by their ancestors. Firstly, they do not have any reliable alternatives and secondly, because it (indigenous knowledge) has been tried and tested. The SSI findings were however; more specific than the findings of FGDs and RAM by dividing the local indicators into those which signal a good rainfall season and a poor one as shown in Table 1. The cause for this could be that in the SSIs farmers were free to give their views without fear of other farmers in the group. This echoed findings by Beckford and Barker (2007) which indicate that social pressures also affect farmers' actions as most people are reluctant to stand out against the general norms and ethos of the community, particularly in traditional society.

The major difference in the findings of the SSIs and those of FGDs and RAMs was that the farmers were also using the official SCF to prepare for the next season. The main reason for this was that the FGDs were held earlier in the study, when farmers highlighted that they exclusively used local indicators since they did not know how to apply the SCFs information. They only started to consider SCFs after they learnt about them

and this was confirmed in the SSIs which were conducted after the two-year study. This was summed up by following quote from one respondent farmer from the SSIs:

> "*Taingoshandisa ruzivo rwedu rokucherechedza kubereka kwemiti nedova kuti tizive kuti mwaka unenge wakamira sei. Asi izvozvi tavakunzwa kunanamazvikokokota wemamiriro ekunze kuti vanenge vachitiwo zvakamira sei*" (We used to rely on studying the fruiting of certain tree species and presence of dew to determine what the season will be like. However, we are also waiting to hear the official SCF from experts).

Table 1. Local indicators used by Lower Gweru farmers to forecast a good and poor rainfall season

Indicators for a good season	Indicators for a poor season
Plenty of raindrops from *Thithamuzi* (raining tree)	No raindrops from the tree
High temperatures towards onset of the rain season	Low temperatures towards onset of the rain season
Early ripening of indigenous fruit trees like *mugan"atsha*, *muchakata*, wild grapes (*tsambatsi*)	No or less fruiting
Presence of dew on trees	Less dew or no dew at all
Birds (*dendera*) arriving early in the season	Late arrival or absence of the birds
Prevalence of north-easterly winds in October-November	Absence of north-easterly winds in October-November

According to the SSI findings farmers were comfortable with using scientific forecasts and appreciated them even more than indigenous forecasts. One of the reasons found was that local indicators were sometimes giving conflicting signals. For example, fruiting of local indigenous tree species (which indicate a good rainfall season) and absence of dew (which signals a low rainfall season) may be noticed or occur before the commencement of a season, yet these two indicators signal different types of season. A second reason was that some of the local indigenous tree species that were traditionally used by the farmers' forefathers for studying have been cut down or have become extinct. Finally, the scientific forecast, which comes in two parts OND (October-November-December) and JFM (January-February-March), was noted to be helpful when making mid-season decisions, especially the timing of certain farm operations like fertiliser application (whether farmers will split-apply or apply the whole amount at once), or making furrows to retain moisture if the second part of the forecast predicts less rainfall. This was seen as an advantage over the local indigenous forecast which gives a rather blanket/broad form of forecast for the whole season, with no indications of the actual amount of rains to be received.

The difference between the findings of the FGD and SSIs was only in the source from which to acquire this information, particularly the official SCF. Farmers highlighted their preferred source of the official climate information to be extension agents. The major reasons for this included that the extension agents are always with them or reside on the farms with the farmers; they explain better than radios and newspapers; and

farmers are able to probe the extension agents further if they do not understand certain issues. The farmers thus trust the extension agents as they offer demonstrations in their own fields and have the interest of farmers at heart. This was also noted by Ziervogel (2001) in a study in Lesotho where most farmers preferred to get the official forecasts from extension agents. This was despite the fact that extension agents in the area had not been giving them this information except for the two-year period they were involved in this study. The reason for that was that they too were also not very familiar with the SCFs before this study.

3.3. Applications of SCF information

Findings from all the three methods used in this study indicate that the nature of forecast whether based on the SCFs or through local indicators guides all farming decisions from land preparation up to weeding. For example if a below-normal season is predicted either by local indicators or otherwise, the farmers would opt to clear their fields of the previous crop residues, make use of conservation strategies like tied ridges, as well as to begin spreading manure early and then plough it into the soil. The purpose for this is to reduce competition of nutrients and the little water by weeds. Farmers prepare land early; invest in fertiliser and high yielding varieties as well as dry planting in anticipation of good rains or an above-normal season. These strategies were also suggested by IFAD (2008) as forms of autonomous adaptation to climate variability and change.

According to RAM findings, the average farm size for the Lower Gweru small-scale farmers was noted to be 2.4ha. However, the farmers were not utilizing all their fields but are only farming a certain portion of their land due to poor yields, poor soils, lack of inputs (fertilizers and hybrid seeds), increased number of below-normal seasons and labour constraints. These low yields are similar to those found by Grant (1981) where it was noted that it is difficult to obtain good yields from these soils without regular large amount of inorganic fertilizers and lime. The average farmed land under maize (staple food) is 0.75ha per household. These findings concurs with findings by Mushiringwani (1983) and Shumba et al. (1993) that these small-scale farming systems are characterized by low productivity, widespread and persistent poverty, low resource base and are usually located in areas with poor soils which give poor returns due to extensive cropping with little or no addition of fertilisers. These poor soils are one of the reasons why small-scale, resource-constrained farmers in developing countries are the most vulnerable to impacts of climate variability and change (Altieri and Koohafkan, 2008).

4. Conclusions

The over reliance on local knowledge and indicators by small-scale farmers is due to a lack of clear proven alternatives. For example, the official forecasts were never made available or explained to small-scale farmers of Lower Gweru Communal area and, hence, the farmers did not know how to use the information. These farmers admitted that their over reliance on local indigenous indicators in the face of climate change is reducing their crop yields and thus endangering their livelihoods. As such, they welcome, consider and even act once they are exposed to relevant technology that alleviates their declining yields of main crops. Relevant

agricultural information or technology outputs should thus be made available to farmers in time to make informed decisions, but it must be done in a way that meets the experiential learning requirements of the farmers.

Most of the small-scale farmers do not keep farming records as evidenced by how they were struggling to map out how they had allocated their resources and the yields they got in the last seasons during the RAM session. This limits their decision-making ability as they do not have accurate information about what worked/did not work for them before or to assess important farm management such as changes in yield. In this study crop yields were said to be declining, but farmers could not quantify the margins of decline, and thus they could not make informed decisions to correct this.

5. Recommendations

The study has highlighted the importance of the extension services to small-scale farmers' learning and training as such there is a need to increase the mobility of the extension agents. This is necessary to ensure that they reach all parts of the communities and impart technical knowledge to farmers. Such information includes the SCFs outputs, and how to apply them to their decision-making, as well as answering other questions that farmers might have. Therefore, the government, through its relevant structures, should come up with a program of equipping the extension services with innovative technologies and knowledge which they should pass on to the farmers in their communities. The meteorological department should engage the extension services in order to avail forecast information early for dissemination to farmers. The extension agents should also be trained in how to deliver clear and well-understood information to farmers. The government should provide inputs at subsidized prices to small-scale farmers, should they require them, so that they can implement their decisions rather than be limited by lack of finances and unavailability of resources. And beyond this, the farmers should be actively engaged in learning about and testing technologies and accompanied through the process of measuring the fit into their farming enterprises and through the decision-making related to these new technologies.

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